PROGRESS REPORTS

FROM

EXPERIMENT STATIONS

SEASON 1956-57

NYASALAND

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PROGRESS REPORTS FROM EXPERIMENT STATIONS

The reports for the seasons up to and including 1950-51 were published in seasonal volumes; the following are still in print and available at 3/- per volume post free.

1923-25 (one volume), 1926-1927, 1931-32, 1934-35, 1935-36, 1942-43 and 1945-46 to 1950-51.

From 1951-52 the reports from each territory were published individually each season. A few of the 1951-52 reports are out of print, but all others are available post free at 1/- per report or 7/6d. for the seasonal set.

NYASALAND

PROGRESS REPORT FOR THE SEASON 1956-57

BY

J. M. MUNRO.

COTTON SEASON.

Province	*Type of crop*	*Legal sowing dates*	*Harvest*	*Legal uprooting date*
Southern \ Central /	Summer	15 Nov.-7 Jan.	Apr.-July	31 July
Northern	Winter	16 Apr.-15 June	Oct.-Jan.	15 Jan.

Rainfall	*Nov.-April*	*May-Oct.*	*Total*
Makanga	28·29 ins.	1·09	29·38
Chitala	47·54 ins.	0·31	47·85

INTRODUCTION.

Makanga Station.

Weather.—Maximum temperatures in October were a little below average. The rains came early, and much of the planting was done in the latter half of November. Wet weather in December and January was followed by light showers in February; there were two falls of over an inch in March. Harvesting conditions were good.

Staff.—Mr. Munro was on vacation leave from 12th September 1956 to 18th January 1957; he visited the Gatooma Cotton Experimental Station before returning to Nyasaland.

Mr. R. C. H. Sweeney arrived at Makanga at the end of September 1956, to start work on the study of cotton stainers under the Cotton Pest Research Scheme. Permission has been obtained to include a note by him in this report.

Mr. D. F. Collings, the farm manager, spent a fortnight in August 1957 in Southern Rhodesia, visiting irrigation projects there.

General.—Mud brick buildings on the station which were damaged or destroyed by the floods last year have been replaced by permanent buildings, situated, as far as possible, on higher ground. A tractor shed and carpenter's workshop have also been built; accommodation is now satisfactory, except for a store for farm produce other than cotton.

The irrigation area has been extended by about 8 acres, and new pumps have been installed.

Cotton Pest Research Scheme.

The main deterrent to cotton growing in the Federation is the damage caused by insects, in particular red bollworm (*Diparopsis castanea*) and cotton stainers (*Dysdercus* spp.). A suggestion for intensified research with a view to controlling these pests was made in 1955 by the Empire Cotton Growing Corporation, and was taken up by the Territorial and Federal Governments. Mr. E. O. Pearson, assistant director of the Commonwealth Institute of Entomology, was invited to visit the Federation in 1956, and put forward definite proposals for the organisation of research. These proposals were approved, and the scheme is being financed by Nyasaland and the Federal Government and from Colonial Development and Welfare funds. Mr. J. P. Tunstall, the entomologist in charge of the scheme, is stationed at Gatooma, where he is primarily concerned with red bollworm; Mr. R. C. H. Sweeney, at Makanga, is working mainly on cotton stainers; the third entomologist has not yet been appointed.

The Cotton Season.

Northern Province.—Floods and heavy rainfall lasted well into June, and the flood plains on which the bulk of the crop is grown were planted very late. The crop amounted to only 400 bales, but was of good quality; rats caused very little damage this year, but picking was late and a number of green bolls remained on the plants when they were uprooted in January.

Central Areas.—Planting was early, but as a result of poor yields in the past three seasons there was not much interest in cotton growing. The lake shore area again experienced a severe attack from red bollworm, and there was considerable stainer damage. The best crops were found in the Dedza district, but the whole crop from the lake shore districts was less than half that of 1955-56.

In the upper Shire valley, there was more red bollworm in the Lisungwe area than last year, but stainer damage was less severe. The crop is about the same as last year.

Lower River.—Planting rains came early, and the bulk of the crop was in by mid December. Heavy rain in December and January caused some waterlogging on the heavy Ngabu soils, and blackarm started to develop. Relatively dry weather in February and March stopped the spread of blackarm, and in general the crop grew well, opening quickly from April onwards; the first markets opened at the end of April. Stainer damage resulted in a high proportion of grade 2 cotton, but the overall average of 25% was much lower than last year. Some very good yields of over 1,000 lb. per acre of seed cotton were recorded in Masanduko, Nyamphota, and Maperera; the average was satisfactory

—about 400 lb. per acre seed cotton, including second grade. In some fields appreciable quantities of ripe cotton were still unpicked when the plants were uprooted.

Cotton Production. — The following figures published by the Agricultural Production and Marketing Board show the production in the three provinces for the last two seasons.

Seed Cotton Purchased in Short Tons.

Province	*1956 crop*		*1957 crop*	
	1st Grade	*2nd Grade*	*1st Grade*	*2nd Grade*
Northern	287	9	243	12
Central	304	151	137	46
Southern	1,392	1,090	2,907	943
Total	1,983	1,250	3,287	1,001

Cotton Breeding.

CLB, CL20 and Albar 51.

The main objective of this season's work was to decide the successor to CLB (Crown Land Bulk), which has been the commercial cotton of Nyasaland since 1933. A longer and finer quality of cotton can be grown successfully, as was shown by the spinning tests on CL20 given in previous reports; and the U4 components of CLB had a staple length of $1\frac{1}{8}''$ (E.C.G.C. Progress Reports 1938-39, p. 142).

Last year's decision to introduce CL20 in the Central and Southern Provinces was to be reviewed in the light of experience this season, and a final decision taken on the best Albar selection for eventual distribution. The trial programme was planned to give the maximum possible information on which to decide these two points.

CLB, CL20, and the best three Albar 51 strains were planted in replicated yield trials at Makanga and Ngabu in the Lower River, at Toleza in the upper Shire valley, and at Chitala in the Central Province. In addition, 147 trials each consisting of a single replication were planted in African cotton gardens throughout the cotton growing districts. The district staff of the Department of Agriculture were most helpful in the carrying out of these trials. Seed cotton from all the trials (except Chitala) was brought to Makanga for weighing.

The trial at Ngabu had to be refilled extensively, and suffered badly from surface wash in December and January. At Chitala, red bollworm attack resulted in very low and irregular yields; the district trials in the Salima area round Chitala were attacked even more severely. Four of the district plots in the Lower River were abandoned because of mistakes in planting.

The remaining trials gave very consistent results (Table 1). The omission of district trials which appeared in the field to give biased

comparisons makes little difference to the overall average, and the figures given in the table include all the trials harvested in the Lower River. Ginning tests were carried out separately on the replicated trials, but only on a sample of the district plots. There was little damage from bacterial blight in the Lower River, and it is therefore all the more satisfactory that A637 has yielded better than CLB. In the last two seasons, when blight resistance conferred an advantage, all the Albars outyielded CLB by amounts ranging from 25% to over 100%.

TABLE 1.

COTTON VARIETY TRIALS.

Lint yields in lb. per acre.

Variety	*Makanga*	*Toleza*	*Lower River**
CLB	381	367	218
CL20	375	434	208
A629	394	468	208
A637	449	489	255
A640	433	489	216
A474	372	443	—
Sign. Diff. (P=·05)	37	43	10
S.E.	±12·8	±14·9	±3·7
Replications	8	8	114
Planted	26.11.56	29.11.56	various

Plot size 1/145 acres. Spacing 3 ft. × 2 ft., 3 plants per hole.

*The Lower River district plots consisted of a single replication on each of 114 African cotton gardens.

District plot trials were also carried out in the central areas. There were not more than ten trials in each district, and pest damage was more severe than in the Lower River, with the result that yield differences were less consistent and not statistically significant. In general, CLB appeared poorer, and CL20 better, in the Central Province than in the Lower River.

Except for its lint quality, CL20 has given disappointing results this season. Yields have been significantly poorer than for CLB; though jassid was not serious in the field trials, CL20 showed greater susceptibility than the other strains; and in several places it showed poorer standing ability. Added to this are the doubts expressed by Mr. Ducker and others as to its suitability for the Lower River. It has been decided, therefore, not to proceed with the distribution of this variety any further.

A637 is the only one of the Albars to outyield CLB in the virtual absence of bacterial blight. It shows an all round improvement, in yield, ginning percentage, lint quality, and bacterial blight resistance,

and will be multiplied to replace CLB as the commercial variety. 33 acres were planted with A637 at Toleza Farm (which is now part of the A.P.M.B. organisation) this season, and were protected by dusting against stainers; a very low seed rate was used, and nearly half the area was planted with "floaters" (light seed separated during acid treatment) but the whole block averaged 700 lb. per acre of seed cotton. Next season, 200 acres will be planted at Toleza, and the remainder of the seed will be grown in a part of the Lisungwe area in the upper Shire valley.

Spinning tests carried out by the Shirley Institute on the 1956 Chitala variety trial lint gave very similar results to those shown in Table 2 of last year's report. Fibre strength tests showed very little difference between CLB, CL20, and the Albar strains, although A640 and A645 gave rather lower Stelometer values. Lint from the 33 acres of A637 at Toleza is being sent to Lancashire for mill testing on a commercial scale.

Albar Crosses.

The Albar 49 crosses (Albar 49 × CL20 and Albar 49 × BP52 × CL20) were tested in variety trials for the first time. These have been rogued for susceptibility to jassid and bacterial blight, and selected for high ginning percentage and lint index over two seasons, but the results are disappointing (Table 2); few of them showed improvement over CLB in yield or ginning percentage, and only two were better than A637. Of 44 strains, the best eight are shown in the table and will be tested next season, but attention will be directed mainly to Albar 51 and its derivatives.

TABLE 2.

ALBAR 49 CROSSES TRIAL.

Makanga—Field 9—Trial 7/4.

Variety	*Yield of lint in lb. per acre*		*Ginning %*	*Lint Index*
	Trial A	*Trial B*		
CLB	516	480	32·4	4·1
CL20	408	422	31·5	3·9
A637	609	600	34·1	4·3
ABC30	566	—	31·4	4·0
ABC31	—	568	33·4	4·3
ABC40	—	626	32·2	3·7
ABC109	—	561	33·0	4·4
ABC120	512	—	33·8	4·1
ABC124	547	—	31·2	3·6
ABC146	—	606	34·4	4·4
AC31	—	581	34·2	4·3
Sign. Diff. (P=·05)	67	80		
S.E.	±23·7	±28·6		

5 × 5 balanced lattices, 6 replications; each plot 1/290 acres. Planted 27.11.56. Spacing 3 ft. × 2 ft., 3 plants per hole.

Over 500 single plant selections were taken from the Albar 51 strains. Each of the four Albar 51 strains A629, A637, A640 and A474 has been crossed with each of the four local and introduced varieties CL20, A618, Uk51 and C(50)20, a total of 16 crosses.

A618 and Uk51 are of similar lint quality to CL20, but C(50)20 is in a class by itself. The Shirley Institute reports that "the outstanding sample of this set was C(50)20, with a count-strength product of 2325. Most of the other samples gave values between 1900 and 2000. The high yarn strength of C(50)20 was probably due to its high fibre strength (Stelometer value 21.8) compared with values from 17 to 20 for the other samples, and to its low fibre weight". Its yield is significantly below that of the local varieties (Table 3), but its crosses should be of value. Some of the newer Uganda progenies have recently been received from Namulonge for planting next season.

TABLE 3.

INTRODUCED COTTON VARIETY TRIAL.

Makanga—Field 3—Trial 7/3.

Variety	*Yield of lint lb. per acre*	*Ginning %*
CLB	550	31·0
CL20	519	30·0
C(50)20	421	29·5
Uk51	558	29·8
A618	565	31·4
Standard Error	± 25·0	
Sign. Diff. (P=·05)	74	

Randomised blocks. 4 replications of 9 varieties, in plots of 1/145 acres. Planted 26.11.56. Spacing 3 ft. × 2 ft., 3 plants per hole.

Long Staple Uplands.

The trial at Karonga in the Northern Province was planted very late, as the usual plot could not be prepared in time after the prolonged floods of the Rukuru river. Yields were poor, and no useful information was obtained.

Ginning Percentage.

Seed cotton samples from the full-scale trials in different parts of the country were roller-ginned at Makanga. The same six varieties are included in the means given below for each trial.

Trial	*Location*	*Ginning %*
Chitala	Central Province	36·9
Toleza	Upper Shire	35·8
Ngabu	Lower River	33·1
Makanga	Lower River (1)	32·1
	(2)	34·1

These results confirm the appreciably lower ginning percentage which has been recorded for the Lower River in the past few seasons. The second trial at Makanga received 4″ of supplementary irrigation in February and March; there is insufficient evidence to draw any conclusions from the higher ginning figure, but the possible effect of irrigation will be investigated in the coming season.

Further information on variation in ginning percentage has come to light through an examination of the records of the ginneries at Chiromo in the Lower River, and Balaka, where the Central Province crop is ginned. The Nyasaland Manager of the British Cotton Growing Association very kindly put his records at my disposal, and Table 4 and Figure 1 are included with his permission.

The ginning percentage obtained at Chiromo is normally slightly lower than at Balaka, but it has fallen by about 1½% from 1952; this was the year when the planting season in the Lower River was advanced.

TABLE 4.

GINNING PERCENTAGE OF TRUST LAND COTTON.

(Grade 1 Seed Cotton)

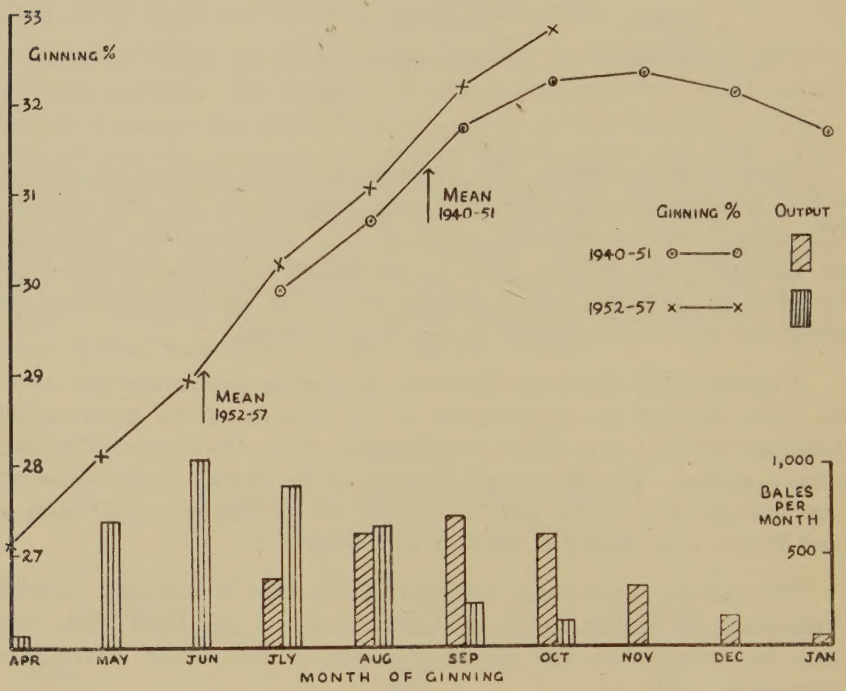
Seasons	*Chiromo*	*Balaka*
1943-1948	31·40	32·00
1949-1951	(no ginning at Balaka)	
1952-1956	29·80	32·00

Chiromo ginnery normally operates for 5-6 months, and the monthly returns of seed cotton input and lint production have been used in Fig. 1. It will be seen that the ginning percentage rises from below 28% in April to over 32% in October, and that there is no fundamental difference between the curves obtained before and after 1952. The figures are for grade 1 seed cotton only.

FIGURE 1.

CHIROMO GINNERY.

Monthly Ginning Percentage and Average Output of Trust Land Cotton, Grade 1.



The movement of seed cotton from field to gin is bound to be irregular, depending on the opening of the markets and transport to the ginnery; deliveries in excess of ginning capacity are stored. In general, however, monthly ginnings are fairly well in step with monthly purchases; cotton stored at the ginnery usually remains in store until deliveries slow down to less than ginning capacity, and will appear in the ginnings at the end of the season.

With these limitations, the changes in ginning percentage through the season have been remarkably consistent, and are of considerable importance to the ginner and the Marketing Board. One possible explanation of the upward trend is that as the dry season advances, from April onwards, seed cotton will dry out gradually; if the seed loses more moisture than the lint, the ginning percentage will rise. On the other hand, the difference noted in small scale tests between the Lower River and the Central Province indicates that the inherent ginning percentage of the crop may be altered by climatic factors.

Whatever the reason for this increase in ginning percentage through the season, it must be taken into account in assessing the results of the early planting and uprooting régime introduced in the Lower River in 1952 to reduce the incidence of red bollworm.

The histograms at the bottom of Figure 1 show the average number of bales of grade 1 cotton ginned each month before and after 1952. Prior to 1952, the bulk of the crop was ginned in August, September and October, with a mean ginning percentage of 31-32%. Since then, June and July have been the peak months, and the average has dropped to 29-30% (see also Table 4; the means shown in Fig. 1 include more seasons than those in Table 4).

Husbandry and Rotation Crops.

Manuring and Fertilisers.

There has been very little response to fertilisers at Makanga this season; this might be due to the silt deposit left after last year's flooding, but a reference to past records suggests that this is not the main reason. Nine fertiliser trials have been carried out here between 1950 and 1955 on different crops, but not one of them has shown that fertilisers improve yields significantly. Yield levels of maize and cotton are, however, not particularly high; it seems that there are limiting factors not yet determined for maize—and possibly for cotton in addition to the important factor of insect damage.

Three maize trials in 1956-57 tested nitrogen and phosphate, each at three levels; detailed results of one of these trials are presented in Table 5. Yield differences in the other two trials were small and not statistically significant. Sulphate of ammonia depressed yields slightly in trial 7/6 (Table 5), but in the other two trials the tendency was the other way. Superphosphate had little or no effect. The middle population level is that recommended for maize in Nyasaland; an increase of 2,000 plants per acre over the recommended population gave only a small increase in yield, which was not statistically significant.

Table 5.

Manuring Trial "A"—Maize.

Makanga—Irrigation A—Trial 7/6.

Nitrogen : 0,250,500 lb. per acre sulphate of ammonia.
Phosphate : 0,125,250 lb. per acre superphosphate.
Population : 12,100, 14,520, 16,940 plants per acre.

Yields of shelled maize in lb. per acre.

Level	0	1	2
Nitrogen	1736	1680	1620
Phosphate	1672	1657	1707
Population	1570	1698	1768
Standard error	± 28·9		
Sign. diff.	88		

Significant effects.

Nitrogen (linear)	−116*	S.E.	±40·9
Population (linear)	+198***	S.E.	±40·9

3^3 factorial. Single replication in blocks of 9 plots, each 1/27·5 acres. Planted 12.12.56. 2″ irrigation on 21.2.57.

Trials 7/6 and 7/7 (Tables 5 and 6) are sited on two of the irrigation fields, where two crops a year are being taken, with no grass or resting

crops in the rotation. If any shortage of the major nutrients develops as a result of intensive cropping, it should show up in increased responses in these trials. The lay-out of the plots will remain unchanged, and fertilisers will be applied regularly to certain crops in the rotation. No appreciable responses are apparent in this first season, but the results are included for future reference.

TABLE 6.
MANURING TRIAL "B"—SOYA BEANS.
Makanga—Irrigation B—Trial 7/7.

Phosphate: 0,100,200 lb. per acre superphosphate.
(Other factors not applied this season)

Yields of soya beans in lb. per acre.

Level	0	1	2
Phosphate	2218	1689	1720
Standard error	±119·7		
Sign. diff.	359		

3^3 factorial. Single replication in blocks of 9 plots, each 1/27·5 acres. Planted 28.12.56. 2" irrigation on 5.3.57.

A very heavy application of muriate of potash gave an increase in cotton yields in one experiment (Table 7). The object of this trial was to see to what extent manuring and spacing could modify growth and earliness, and the high rates of fertiliser were applied intentionally to unbalance the supply of major nutrients. In fact, they had no appreciable effect on vegetative growth or fruiting pattern of the cotton; the plots were picked weekly, but no plant diagrams were recorded.

TABLE 7.
MANURING AND SPACING TRIAL—COTTON.
Makanga—Field 3—Trial 7/5.

Main Plots.

Phosphate: 0, 1 ton per acre superphosphate.
Potash : 0, 1 ton per acre muriate of potash.

Sub-plots.

12", 18", 24" spacing, 3 plants per hole, 3 foot ridges.

Yields of lint in lb. per acre.

	k^0	k^1
p^0	443	543
p^1	451	477
Standard error	±22·2	
Sign. diff.	72	

12" spacing 496
18" spacing 470
24" spacing 458

Standard error ±16·0
Differences not significant.

Interactions not significant.

2 × 2 factorial, with split plots. 4 replications. Split plots each 1/202 acres. Planted 26.11.56.

Ridging and Mulching.

The results of trial 4/2 are given in Table 8; this is the fourth consecutive season in which these treatments have been applied. Ridged and tie-ridged plots yielded much the same as flat in 1955 (maize) and 1956 (cotton stalk weights); they gave large increases in maize yields in 1954, a dry year, and moderate increases this season. Mulching has given considerable increases in yield in three years out of four.

TABLE 8.

RIDGING AND MULCHING TRIAL—MAIZE.
Makanga—Field LT.3—Trial 4/2.

Yields of shelled maize in lb. per acre.

Flat cultivation	2121	No mulch	1825
Ridged	2304	Light mulch	2102
Tie-ridged	2436	Heavy mulch	2935

Standard error ± 81·7
Sign. diff. (P = ·05 234
Interactions not significant.

3 × 3 factorial. 6 replications of 9 plots, each 1/80·7 acres. Planted 29.11.56. Spacing 3 ft. × 3 ft., 3 plants per hole.

Irrigation.

The irrigation programme and technique was not fully worked out until the start of the 1957 dry season. Supplementary irrigation was applied in some fields in February and March to the wet season crops, but no comparison was made between irrigated and non-irrigated yields.

The Agricultural Chemist has taken a series of soil samples from the Makanga irrigation soils to a depth of six feet; they have been found similar to the Class I soils of the Elephant Marsh. A survey of these soils was carried out by Hunting Technical Services between June and December 1956, to complete the preliminary investigation of the lands of the Lower River area between Chikwawa and Chiromo.

The irrigation work at Makanga has three main objectives. The first is to obtain information on the yields to be expected from as wide a range of crops as possible. This information is necessary for planning a cropping programme to make the most profitable use of reclaimed and irrigated land. In their report, Sir William Halcrow and Partners have given estimates of the cost of the Shire Valley Project, but there is very little information on the agricultural returns which may be anticipated.

The second objective is to ascertain the water requirements of the crops which are being grown, and to relate them as simply as possible

to standard meteorological evaporation records. Since water requirements and yields are inter-related, water is being applied in the first place according to Penman's estimate of irrigation need—0·8 times the evaporation from an open water surface.

Maximum yields, combined with economy in the use of irrigation water, require measured applications of water. The third objective will be to try out various methods of applying water suitable for African farmers in the Lower River; and to investigate what methods of water measurement might be used.

Diseases.

Bacterial Blight.

Bacterial blight infection was not reported on seedling cotton, but angular leaf spot developed rapidly towards the end of January. In some areas lesions on the stems, branches and the growing point seriously affected growth, but this occurred mainly in fields with standing water, and some fields with poor growth where cotton had been grown for many years.

The dry weather in February checked the spread of the disease, and on the whole it caused little damage this season. The worst damage seen was to the south of Ngabu in the Lower River, near Ntakataka in the Dedza district, and in the Salima lake shore area.

On Makanga, what appeared to be angular leaf spot was found on some of the Albar 49 crosses, but proved to be so local and patchy that roguing and grading for resistance was discontinued. No artificial inoculation was used this season in testing for blight resistance, but equipment for this has now been obtained and will be used next year.

Pests.

BY

R. C. H. SWEENEY.
(*Cotton Pest Research Scheme*)

Diparopsis castanea. (*Red or Sudan bollworm*).—The main moth-flight this season occurred from December to February with the peak emergence in early February. The peak period of egg-laying occurred in March-April.

Although the initial infestation was high, the heavy losses that were expected from red bollworm did not materialize and the later fruiting points set and matured with comparatively little loss from this insect. A considerable amount of early shedding due to red bollworm took place and this was most severe in parts of Port Herald and Chikwawa Districts. Most shedding occurred before the end of March. Shed

examinations showed that between 50% and 95% of all sheds were due to red bollworm. Samples of green bolls showed a progressive decrease in damaged bolls and numbers of living larvae, but even the early samples showed less than 5% green bolls damaged.

The pattern this season is of interest in that it differs from those recorded in 1940-1944 by Pearson and Mitchell, whose sample gardens were mainly planted in late January. In those years the records of larvae start at a low level in March, build-up to a peak about May, and then fall off more or less gradually.

Soil sampling for red bollworm pupae after cotton uprooting in July and August showed the pupal population to be only about 160 per acre. This is considered to be low, and the numbers are very considerably less than those found at Gatooma in the same period.

The incidence of red bollworm in Central Province appeared considerably higher than in the Lower River.

Dysdercus spp. (*Cotton stainer*). — Stainer damage has been considerable, but apparently not as severe as in 1955-56 since the percentage of Grade 2 cotton marketed has fallen from 43% to 25%. However, this is not necessarily a true indication of stainer numbers since by no means all the Grade 2 cotton is marketed. This season over 200 lb. per acre was found in some gardens in the Lower River after the grower had finished picking. On the station the average figure for Grade 2 cotton was about 50% but the plants were stripped more thoroughly than in the African gardens.

The first invasion of the cotton crop came in February-March and the first species to arrive in numbers was *D. intermedius.* This species also began to leave the cotton crop in early June, some six weeks earlier than *D. fasciatus,* the other species of importance. The latter only occurred in any numbers on the crop about a month after *D. intermedius. D. nigrofasciatus* was never very common.

Only some 10% to 15% of green bolls were found damaged in samples from African gardens, but on the station between 30% and 50% of the locks were damaged in March. Since the samples in outside gardens were small, and having regard to the Grade 2 percentage, it is thought that the figure should be higher.

The great majority of the stainers arrived on the cotton crop flighting from one host-tree, *Sterculia africana,* which was by far the most important pre-cotton host. This initial infestation and the F_1 and F_2 generations bred in the cotton caused most of the damage this season, since few stainers arrived on the crop after the end of the initial invasion from outside sources, and breeding in the crop was severely curtailed owing to the dry weather later in the season. Damage was apparent, however, throughout the season, although most damage was caused in the earlier months.

Stainer damage was fairly uniform in the Lower River and Central Province with little to choose between the two regions.

Empoasca facialis and other jassids.—Like most of the other pests of cotton, jassids were numerous at the beginning of the season and damage was noticeable in some gardens from December to early February; the numbers diminished rapidly and little or no damage was found later in the season. The situation was much the same in Central Province. Susceptible cotton on the station was very badly damaged, however, and jassids persisted on this variety almost throughout the season.

Earias biplaga and Earias sp. (*Spiny or Egyptian bollworm*).—In December this species competed with red bollworm in numbers and damage, but later in the season the damage was only minor. In some gardens it was more numerous than red bollworm early in the season. It was the only other bollworm of importance this season in the Lower River.

Heliothis armigera. (*American bollworm*). — The moth-flight occurred at much the same time as that of red bollworm but numbers on the crop in the Lower River were very small and damage this season was negligible. In some areas of the Central Province damage was quite considerable and the population was obviously greater; it was more important than spiny bollworm in this region.

Anomis flava.—This species was common on the station in April and May, and the larvae were found as the commonest caterpillars on many fields in the Chiromo area during the same period. The appreciable damage was slight, however, and the pest did not persist for long.

Sylepta derogata. (*Cotton leaf-roller*).—Found locally in some numbers in February and until April, tailing off in May. In Central Province, notably at Lisungwe, this pest was noticeably more common in May than in the Lower River. The occurrence was sporadic, however, and only rarely was any severe damage done.

Platyedra gossypiella. (*Pink bollworm*).—This pest was only noticeable by its absence and not a single record was obtained in the Lower River. *Pyroderces simplex* was very common; this is a scavenger in opened bolls, and its young larva is superficially very similar to pink bollworm.

Calidea dregii.—Only occasional specimens were found and it never reached pest proportions.

Oxycarenus hyalinipennis. (*Dusky cotton stainer*). — Very commonly found breeding in open bolls and occurred in large numbers this season, first becoming common towards the end of March. Damage done was not assessed but some discolouration of the seed occurred.

Helopeltis bergrothi.—A small and local amount of damage was found in the Lower River but in general this pest appeared to be rare. It was commoner in Central Province, where locally around Salima, Chitala and Ntakataka some considerable damage occurred to the growing points and leaves, but boll damage was uncommon.

Apion armipes and other Apion weevils.—This species was of some considerable importance in Tengani and Chikwawa district locally. In a few gardens numerous plants had the growing point destroyed or were ring-barked, and contained several larvae each. Some damage, usually slight, could be found in most gardens. In Central Province, near Chitala, and in the Salima area, some considerable damage was observed in a few fields, and damage was reported to be worst in Kota Kota district and around Golomoti.

Alcidodes (*? leucogrammus*).—Not as common as Apion, but as the damage is similar, some of the damage attributed to Apion may have been due to this weevil. It was found at Tengani and Dolo mainly together with Apion and, occasionally, in the same plant. It was also recorded locally in Central Province.

Zonocerus elegans. (*Elegant grasshopper*).—Some considerable local damage to seedlings occurred, the pest first occurring in numbers in early November when quite large hopper swarms were found after the first rains. In a few gardens considerable replanting was necessary. Later in the season defoliation of individual plants occurred and although damage was sometimes quite noticeable locally it was nowhere severe.

Hodotermes mossambicus. (*Harvester termite*). — A common species very active in the early rains, which occasionally did considerable damage to seedlings locally. The elegant grasshopper and this termite are the only two important pests of seedling cotton in the Lower River, although millepedes occasionally do some damage. In some gardens, particularly in the Sorgin area, very considerable resowing was necessary in November and December owing to the harvester termite, but these were comparatively isolated cases. Older plants were rarely attacked.

Appendix.

Origin and Special Characteristics of the Main Cotton Strains Mentioned.

CLB	Crown Land Bulk, the commercial cotton of Nyasaland, mainly of U4 origin.
CL20	A selection from CLB with better lint quality.
Albar	A general term for selections from Nigerian Allen, highly resistant to bacterial blight. Two series of selections have been made, Albar 49 in 1949, and Albar 51 in 1951.
A629 A637 A640 A474	Selections made at Namulonge from Albar 51, chosen as suitable for Nyasaland conditions.
ABC30, etc.	Selections from a panmixis bulk containing Albar 49, BP52, and CL20.
AC31, etc.	Selections from a panmixis bulk containing Albar 49 and CL20.
A618	A Barberton selection from the cross MU8 × BP52 × BP52; widely grown in South Africa and Portuguese East Africa.
Uk51	A Ukiriguru seed issue: the commercial cotton of the Lake Province, Tanganyika.
C(50)20	A Namulonge selection from BP52.
U4	The jassid resistant selection made from Uganda Upland by Parnell, which was the basis of much of the cotton breeding at Barberton.

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